Hi Tech Ham Radio at http://www.amrad.org

# The AMRAD Newsletter

The Amateur Radio Research and Development Corporation

Volume XXIV No.1 Jan-Feb-Mar 1997

## BULLETIN!

The annual AMRAD Hamvention lakeside convocation at Skip Pratt's farm is set for Friday, May 16, 1997. Events will start around 5:30 p.m. If you are planning to attend, please send e-mail to "fpratt@dayton.adroit.com". Late breaking news regarding the picnic will be posted on E-Mail for those responding, including directions and talk-in frequency.

Skip (N2FOE) should have a flea market spot at Hamvention. If some of the AMRAD attendees wish to setup and man a booth at the location, they are welcome. If not, the space may revert to a cache to store goodies and a general meeting spot. More information will be available once the flea market spots are assigned.

The Dayton picnic has become one of the AMRAD traditions and all are welcome to come, visit and renew old acquaintances. AMRAD membership is not a requirement so if you are with other friends and wish to stop by with them, please do so; the membership chairman or designated representative will, however, be available to take any applications from the visitors. There is no pressure to join, however members will wear very stylish bright red, white, and blue name tags while guests will have their names written on their foreheads with a green magic marker.

The secret AMRAD flare lighing ceremony replete with flames and appropriate speeches is planned. Those with GPS units are encouraged to bring them and help calibrate Skip's pond to validate that the location is or is not moving under the earth's crust. Non-members may attend the ceremony if they sign a non-disclosure agreement which has severe penalties for telling anyone about the part of the ceremony involving the small model of a Viking ship.

AMRAD - Hamvention 97...Be there for great time

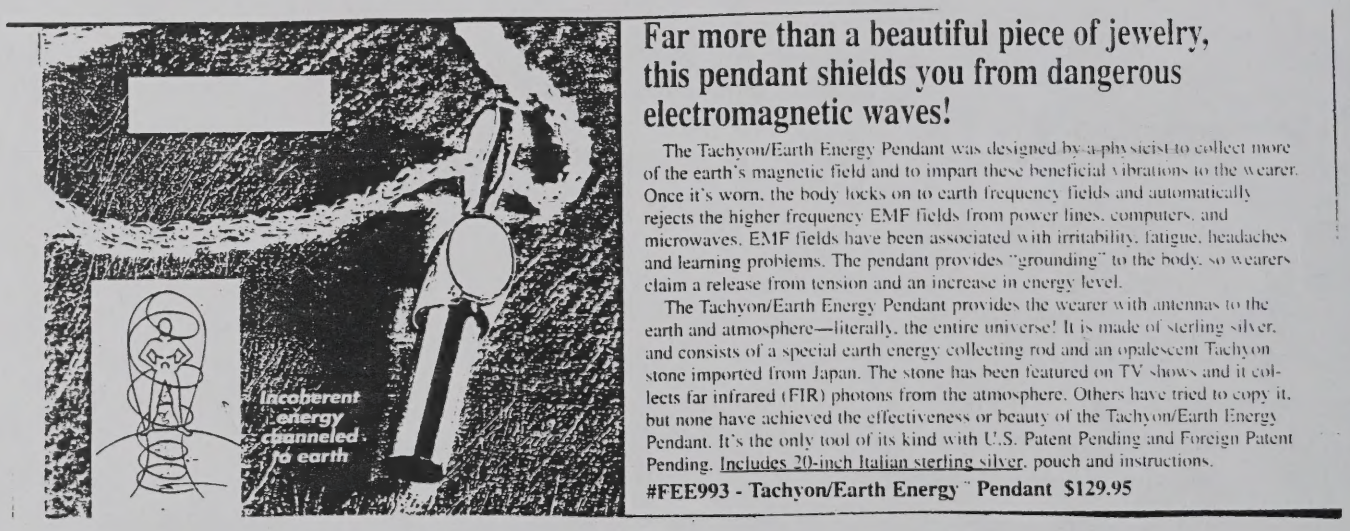
## The Science Corner:

by the AMRAD Chief Scientist.

Our Readers know that we, at AMRAD Galactic Headquarters, are totally dedicated to the pursuit of Scientific Truth and Technical Excellence. Hence it was with delight that we recently discovered that we, here in the US, could finally obtain from one of those glossy mail-order catalogs the Japanese-designed Tachyon/Earth Energy pendant for a mere $129.95

Because of the size of the small print of the advertisement, we have taken the liberty to extract here some of the highlights of the technical information supplied in the magazine.

For instance, it is explained that the pendant *collects the earth's magnetic field* and that the *body locks on to the earth frequency fields* and automatically rejects the high frequency EMF fields from power lines. Furthermore, the stone mounted in the pendant *collects far infrared photons* from the atmosphere. The pendant, it is also explained, provides *grounding* to the body.




**Far more than a beautiful piece of jewelry, this pendant shields you from dangerous electromagnetic waves!**

The Tachyon/Earth Energy Pendant was designed by a physicist to collect more of the earth's magnetic field and to impart these beneficial vibrations to the wearer. Once it's worn, the body locks on to earth frequency fields and automatically rejects the higher frequency EMF fields from power lines, computers, and microwaves. EMF fields have been associated with irritability, fatigue, headaches and learning problems. The pendant provides "grounding" to the body, so wearers claim a release from tension and an increase in energy level.

The Tachyon/Earth Energy Pendant provides the wearer with antennas to the earth and atmosphere—literally, the entire universe! It is made of sterling silver, and consists of a special earth energy collecting rod and an opalescent Tachyon stone imported from Japan. The stone has been featured on TV shows and it collects far infrared (FIR) photons from the atmosphere. Others have tried to copy it, but none have achieved the effectiveness or beauty of the Tachyon/Earth Energy Pendant. It's the only tool of its kind with U.S. Patent Pending and Foreign Patent Pending. Includes 20-inch Italian sterling silver, pouch and instructions.

**#FEE993 - Tachyon/Earth Energy™ Pendant $129.95**

As our AMRAD Chief Scientist, with the enthusiastic approval of the AMRAD Board of Directors, was about to send for one of these $129.95 marvels he discovered, in the next issue of the same glossy catalog, that the price had dropped to a trivial $99.95

Crucial additional technical information was also released:

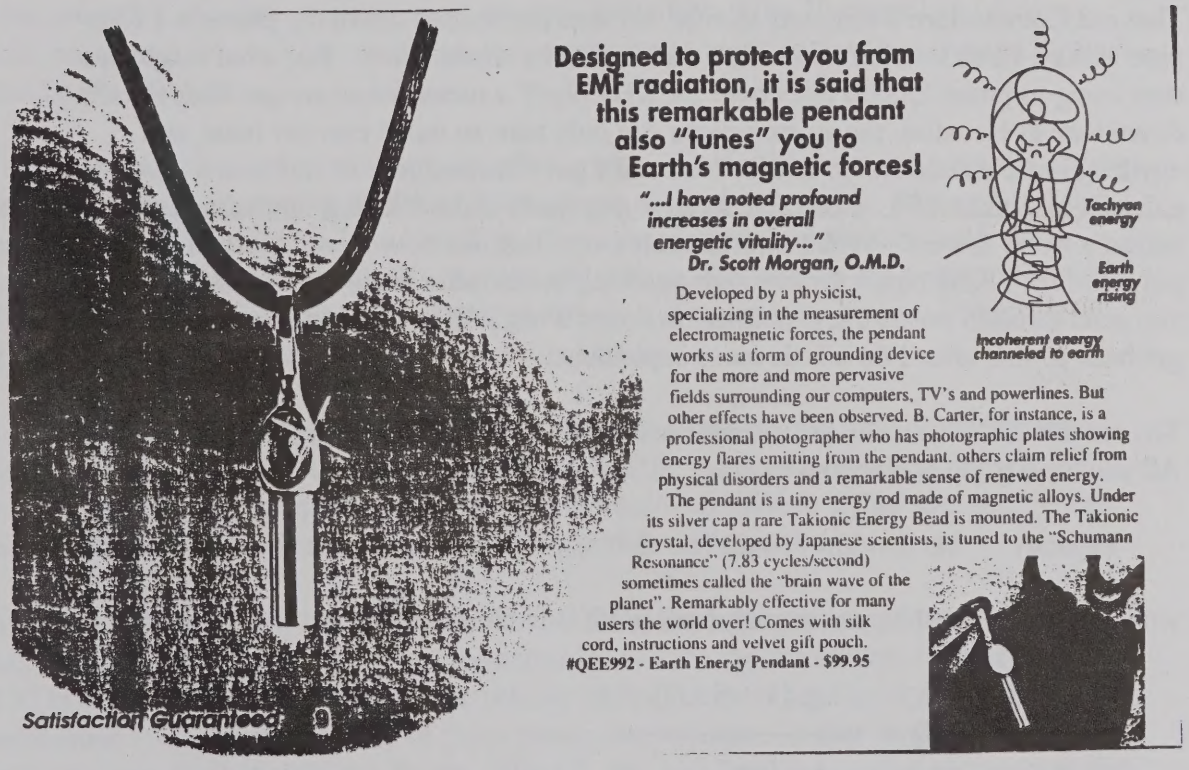
- photographs plates have been taken of the pendant emitting *energy flares*,
- the Takionic crystal is tuned to the *Schumann resonance of 7.83 cycles/second*
- the Schumann frequency is sometimes called "*the brainwave of the planet*".

If we understand correctly the two supplied illustrations, the Tachyon Energy Pendant contains:

- a sort of phase-locked loop at 7.83 Hz,
- a shield which protects from radiation above 59 Hz,
- a collector of Far Infra-Red radiations,
- an emitter of energy flares,
- an antenna to the entire universe

and provides the wearer the following advantages:

- increased energy level,
- release from tension
- relief from physical disorders, and
- guaranteed satisfaction.


Satisfaction Guaranteed
Designed to protect you from EMF radiation, it is said that this remarkable pendant also "tunes" you to Earth's magnetic forces!
"...I have noted profound increases in overall energetic vitality..."
Dr. Scott Morgan, O.M.D.
Developed by a physicist, specializing in the measurement of electromagnetic forces, the pendant works as a form of grounding device for the more and more pervasive fields surrounding our computers, TV's and powerlines. But other effects have been observed. B. Carter, for instance, is a professional photographer who has photographic plates showing energy flares emitting from the pendant. others claim relief from physical disorders and a remarkable sense of renewed energy.
The pendant is a tiny energy rod made of magnetic alloys. Under its silver cap a rare Takionic Energy Bead is mounted. The Takionic crystal, developed by Japanese scientists, is tuned to the "Schumann Resonance" (7.83 cycles/second) sometimes called the "brain wave of the planet". Remarkably effective for many users the world over! Comes with silk cord, instructions and velvet gift pouch.
#QEE992 - Earth Energy Pendant - $99.95
Tachyon energy
Earth energy rising
Incoherent energy channeled to earth

Another Free Service to AMRAD Members: If a sufficient number of AMRAD members were to want to purchase such a pendant for their personal use, we at AMRAD Galactic Headquarters would be prepared to approach the Marketing department of the Glossy Catalog in question, and try to obtain quantity discounts. Should you attend the Dayton Hamvention, please indicate your interest to Skipp Pratt N2FOE at booth #3425.

**Nagging Theoretical Stuff**
by Alan Eynon, N3IRL

If you have had the pleasure of owning a computer, there is a good chance you have owned one or more modems. My first modem plugged into my Commodore 64 and ran at a breathtaking 300 bits per second (bps). The current unit I have runs at 14,400 bps. If you deal with modems at all, you know that 14.4 Kbps modems are outdated. Even 28.8 Kbps modems are going out of style - just check any handy mail order computer catalog and you can watch their prices drop month by month. Why should you care about this? And what the blazes does this have to do with radio? Bear with me a minute to find out.

The interesting thing about those modems is that they all operate over the same telephone line. We generally assume that a phone line has about 4 KHz of bandwidth, which on the scale of generalizations is not too far off; you probably can not get the phone to send frequencies below 40 Hz, and the upper limit starts rolling off around 3700 Hz, but let us run with 4 KHz for a moment.

That old Commodore 64 modem shoved 300 bits per second down my phone's 4 KHz pipe. Okay, I can see that - sort of like a trickle in a storm sewer. But what magic are they using to pump 28,000 bps down a 4 KHz pipe? I mean, when we get flash flooding down here in Houston, the storm sewers can only take so much rain per hour, and anything more stands on the street. You can't put 6 inches/hour of rain into a sewer with a design maximum of 4. Could the modem engineers make a killing upgrading our nation's storm sewers? Well (unfortunately), no. But just how much information can you put into that 4 KHz pipe? Or - to start working in the radio angle - how much data can you send through the 50 Hz CW filter on your HF rig? Why should you even care? I'll get back to that after I do a little more explaining.

The answer is that you can put as much information through them as you want. Really. All you have to do is obey the law:

$$\text{capacity} = \text{bandwidth} * \log2\,(1 + S / N)$$

where capacity is in bits per second, bandwidth is in Hertz, and

$$\log2\,(1 + S / N) = \frac{\log\,(1 + S / N)}{\log 2}$$

This limit was discovered by Claude Shannon, and it tells you the maximum bits per second rate you can send through a channel at a given signal to noise ratio (SNR).

And that is where we have to deal with the fine print. The other two quantities you have to control are signal power (S) and noise power (N). Signal power is measured by the S unit meter on your rig. Noise power is, too, if it has enough punch to make the needle twitch. I will deal with power in decibels (dB), but you can think of 1 dB as one sixth of

an S unit on your meter. Assuming that it does not cause any additional distortion, you can crank up the data rate by cranking up the power on your rig.

As an example, if we pull out the old calculator and start poking in values for the standard 4 KHz bandwidth telephone channel, we get:

| S / N (dB) | S / N | log2(1 + S / N) | capacity (bps) |
|---|---|---|---|
| -20 | 0.01 | 0.0144 | 57.4 |
| -10 | 0.10 | 0.1375 | 550 |
| 0 | 1.00 | 1.00 | 4,000 |
| 10 | 10.00 | 3.46 | 13,837 |
| 20 | 100.00 | 6.66 | 26,632 |

where, like EPA miles/gallon ratings on cars, your mileage may vary. Those capacity figures are the theoretical maximum. We, who actually have to operate with real equipment, will obtain somewhat lower performance. If you could get your hands on what we call a noiseless channel (and I am not talking about the 10 meter band during solar minimum) where S / N is infinite, you could put as much data as you wanted through that 50 Hz CW filter.

The companies that design modems use other tricks - like forward error correction coding - to help squeeze as much out of the 4 KHz phone channel as possible. Not only are they dealing with the bandwidth limit of 4 KHz, they also have to fight the maximum SNR available on a phone (about 20 dB). Like I said before, cranking up the power only works if it does not cause distortion, and if you have ever had to listen to someone who was talking a little to loud on phone, you see what I mean.

So, why should you care about all this? We hams have had to deal with power issues since the beginning. The QRP crowd really knows the value of each watt of power. We put up beams to help channel our signals and increase our relative signal strength. What may not be so obvious is that we are terrible gluttons of bandwidth.

A typical FM signal may occupy more than 30 KHz, depending on the index of modulation and all that stuff we had to memorize to take the ham exams. It carries about 3 KHz of voice. Our friends (?) in the cellular phone business can use digital compression techniques to accommodate two or three phone conversations in that same bandwidth - and may soon up that ratio to a dozen. Magic? No, just the same careful engineering that lets our computer modems shove 36,600 bps down a telephone line.

If you read QST or any of the other radio magazines, you know that our friends are asking the FCC to give them some (well, all really, if they had their way) of our bandwidth. Who do suppose the public will favor? How many people do you know that have benefited from sending telegrams by amateur radio? Or care that you helped out at their last 10K fun run? A huge market exists for more cellular phones, and if the phone companies go to

the public and explain that they will have to charge more for cellular phone service because that pesky minority of ham radio operators is blocking access to radio frequencies that they need - frequencies that they can use much more efficiently that we can - who is going to look like the sourpuss?

Comments? Questions? Suggestions? Please e-mail me at aeynon@micro.ti.com.

* * *

**Some Gratuitous Comments**
from André Kesteloot N4ICK

Right on, Alan! *We Amateurs **used to** create and build wonderful things.* Examples? In the 30's the Amateur Radio Community built multi-tube HF transmitters, designed better receivers and experimented with new antenna concepts; in the 40's we built incredibly ingenious VHF equipment; in the 50's we bounced signal against the Moon; in the 60's we made SSB a reality; in the 70's ATV and FM repeaters became the "in" thing to build; and in the early Eighties some of us were designing and building our own TNCs, and pushing packets on the 2 Meter band at a (nominal) rate of 1200 bps. These were truly wonderful things. Now, sixteen years later, we are still pushing data at that same nominal (and rarely attained) rate. One must admit that the wonderfulness of our achievements has faded somewhat! I still recall that Terry Fox WB4JFI, in 1986, presented to the 5th Computer Networking Conference in Orlando a paper entitled "RF, RF, Where Is My High Speed RF?" but, as far as I can see, the Amateur Radio community has achieved very little in the RF field since then. Shame, where is thy blush?

It seems to me that the future of Amateur Radio is bleak at best because, among other reasons:

- HF: we will probably be allowed to keep our HF bands, and thus will be able to continue exchanging, through the pile-ups, meaningless "599, OM" in our quest for the DXCC,
- Above 900 MHz: experiments above 900 MHz are really difficult unless one has access to expensive test equipment.
- Components: a lot of the integrated circuits developed today are of the surface-mount variety, making it impossible for the average amateur to work with them.
- VHF and UHF: these bands are very, very attractive to LEOs and Paging service operators.
- YOU: When was the last time that ***YOU***, dear Reader, designed and built something new in the RF domain? ("Well, you know, I don't really have the time, what with the Internet and television...")

The sad reality is that the appliance operators have won, and Amateur Radio, as we have known it, will soon die *unless*, as Alan Eynon suggests in the above article, we do something to become again "experimenters" and improve our technology. Otherwise indeed, why should we be given access to all those valuable (as in *beaucoup* $$$) portions of the RF spectrum?

The one thing we do contribute to the community is our ability to react quickly and help in emergencies. How much will this weigh in the balance, under the pressure of those promoters who have real money-making designs they could implement if only they were given access to our VHF and UHF bands?

Comments? Questions? Suggestions? Please send them to me, N4ICK@amrad.org

## AMRAD Meeting Notes

### Here are some notes from recent meetings written up by Dick Barth, W3WHN

### Maitland Bottoms on Unix display software for EMWIN, the Emergency Managers' Weather Information Network

In the Washington DC area, NWS is currently transmitting a 163.35 MHz AFSK signal compatible with a Bell-202 modem. It uses 8 bits, no parity and 1 stop bit. It transmits nationwide weather information which can be displayed on a Windows-equipped PC. Maitland checked the NWS web page looking for further information on EMWIN and found that the transmitter, which is located atop the NWS headquarters building in Silver Spring will move to 400.175 effective 1 October 1996. [Late note: the change has been postponed, at least until the early part of 1997.] Since he does not have a radio capable of receiving the new frequency, Maitland decided he'd better do something with the signal while he could still hear it. He started by connecting an AEA PK-232 packet modem to the radio, and found out that it wouldn't do the job. It filtered out all the nulls in the signal and passed the ASCII text, allowing him to pick up all the text bulletins which make up a large part of the EMWIN contents. However, he wasn't able to receive the graphics images which make up another large part of the EMWIN data suite.

The next step was to borrow, from Terry Fox, one of Maryland Radio Corporation's (MRC) demodulators. (These are designed specifically for EMWIN use; Maryland Radio has been working closely with the NWS in the commercial development of hardware and software for EMWIN reception.) Beta code for EMWIN reception on UNIX is available on the net. Terry discovered that to work with the MRC demodulator, it was necessary to invert the signal by slightly modifying the demod. Work on Unix EMWIN software is continuing.

In addition to the Silver Spring VHF transmitter, the EMWIN signal is available via downlink from NOAA's GOES satellites. It is uncoded and freely available; anybody with a satellite receiver can pick it up and do what he likes with it. It is expected that some local government and private organizations will redistribute the data via local radio links, subcarriers on FM broadcast transmissions and the like. The NWS has hopes, but no current budget, to construct a nationwide network of EMWIN transmitters.

Maitland is particularly interested in the line vector format used in EMWIN's representation of things like weather fronts and isobars, etc. The MRC software displays these very nicely, and Maitland is trying to figure out a Unix equivalent. One of his first steps was to rewrite the NWS documentation, which describes an earlier version of EMWIN (then called WWIN). Some of the scanned illustrations were redone and the text simplified.

EMWIN Graphics are designed to be processed and displayed on a PC, and some manipulation may be needed to make it useful under UNIX.

### George Lemasters, on video compression.

New standards are being developed which are causing a reduction in hardware costs and the development of software which is widely useful. New systems are being developed for the consumer market. "Full-motion" color images, duplex audio and shared computer applications across mixed platforms are being developed.

The ITU's telecommunications standards body (ITU-T) agreed around 1990 on a standard called H.320. A suite of standards covers methods of video compression, audio compression, channel setup and negotiations, frame construction, etc.

H.324, approved last year, uses V.34 (28.8 Kbps) modems to transmit video and audio. Equipment meeting this standard is already on the market.

H.323, approved in June 1996, defines putting H.320 video and audio information on a token ring or ethernet lan. It could also be used over the Internet if sufficient bandwidth could be reserved for the link. H.324, covering mobile operation, is expected to be approved in Spring 1997. It contains a new audio algorithm that is optimized for the low data rates used. Changes in the multiplex and and control mechanism make it more robust.

H.322, another recent standard, takes ethernet information at 16 Mbps time-slots it, providing 6 Mbps of guaranteed channel bandwidth for video conferences or what not. It's called isochronous ethernet.

T.120 is a standard used to provide cross-platform data transmission. It covers the process of pulling the bitmap off a video screen, transmitting it to the other end and displaying it there.

There are a number of related standards, but these are the ones which are most likely to find applicability to amateur radio and computing. It might, for example, be possible to apply them to future generations of amateur satellites. PC cards are available from a number of manufacturers that implement the protocols for multimedia compression and transmission. Hardware is also available for some other platforms.

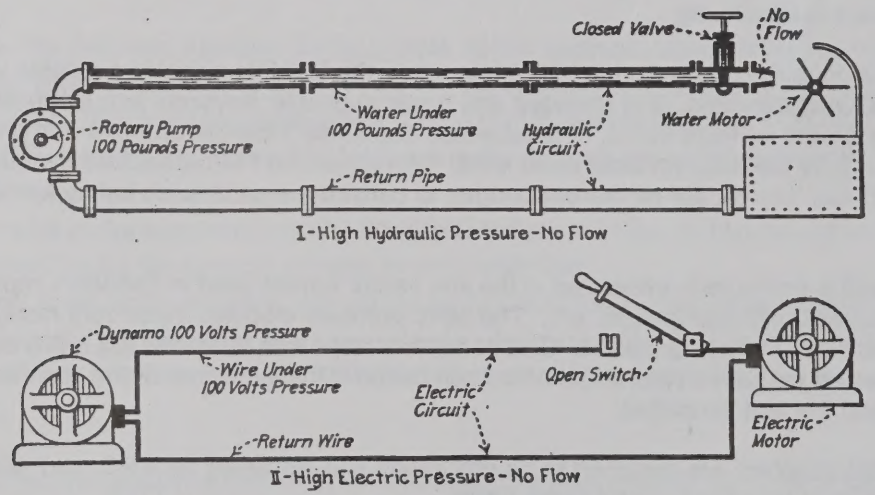



FIG. 78.—Showing how there can be great pressure and yet no current in both hydraulic and electric circuits.

**Stop Press:**

The Dayton Hamvention Committee has just released flea-market spots. The spot issued to Skip Pratt N2FOE, and available to AMRAD Members is #3425. For those who visited the space last year, it is approximately at the same location. If you did not visit last year, record this number and check the location in the Hamvention Magazine. Those wishing to use the N2FOE spot to sell some gear, pass out information about AMRAD, or just have it as a place to store your flea-market treasures until a suitable truck can be rented for the trip home, contact Skip Pratt at <fpratt@dayton.adroit.com>

# The AMRAD Page

As you can see from the front page bulletin, it won't be long until the 1997 Dayton Hamvention. Each year several of us go over there to mingle with ordinary ham radio enthusiasts, answer their questions about AMRAD, and sign autographs.

If you have never attended the Dayton Hamvention, 1997 would be perfect year to go. After hearing the horror stories about heavy rains, occasional snow, muddy parking areas, and the crush of humanity inside the Hara Arena, many people have hung back, reluctant to drive that short 500 miles across Pennsylvania, West Virginia, and Ohio. Since the dates were moved from late April to mid-May, the Hamvention weather has improved quite a bit. If possible, go over on Thursday, and join us Friday night at Lake Pratt for the good food and very impressive ceremony.

On a different topic, if you are not receiving the very informative mailings sent to "tacos@amrad.org," please contact aa4hs@amrad.org to have your e-mail address placed on the mailing list.

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Actual AMRAD MEMBERSHIP APPLICATION
Mail to AMRAD, Box 6148, McLean, VA 22106-6148
(but be sure to fill it out first!)

Annual Dues: Regular $20; 2nd in family at same address add $10; Canada and Mexico add $2; foreign surface mail add $2.30; foreign air mail add $8; if you live in the Metro DC area and use the very sophisticated wide area coverage AMRAD 2 meter repeater, please consider an additional donation for the upkeep of this equipment.

Name_____ Call _____ License class _____
Street Address _____
City _____ State/Province _____ Zip/Postal Code _____
Phone _____ (work) _____(home)
E-Mail address _____ ARRL member? _____

Interests __ deaf communications __RTTY/HF data __packet __spread spectrum
__DSP __satellites

I support the purposes of AMRAD.

(signed) _____

Everything you ever wanted to know about AMRAD. The Amateur Radio Research and Development Corporation (AMRAD) is a worldwide club of several hundred amateur radio and computer experimenters. AMRAD is incorporated in Virginia and is recognized by the U.S. Internal Revenue Service as a tax-exempt scientific and educational organization. The purpose of AMRAD is to develop skills and knowledge in radio and electronic technology, advocate design of experimental equipment and techniques, promote basic and applied research, organize technical forums and symposiums, collect and disseminate technical information, and provide experimental repeaters. AMRAD meetings are held on the second Thursday of each month at the Dolley Madison Library in McLean, VA. If the second Thursday is a holiday, an alternate date will be announced in the newsletter or on the AMRAD BBS. Except for the annual meeting in December, meetings are reserved for technical talks - not business. AMRAD is affiliated with the American Radio Relay League (ARRL), Foundation for Amateur Radio (FAR), Northern Virginia Radio Council (NOVARC), and the Mid-Atlantic Repeater Council (T-MARC). AMRAD airs "Newsline" every Sunday night at 8 p.m. on the WD4IWG repeater (147.21 MHz). Our Internet address is ramays@amrad.win.net. Our CompuServe address is 73156,2540. AMRAD has several computer bulletin board systems. The AMRAD Information Center, a real whiz-bang UNIX deal, is at (703) 849-1161. The Handicapped Education Exchange (HEX) is operated by Dick Barth, W3WHN. HEX has two numbers: (301) 593-7033 for TTYs and (301) 593-7357 for computer modems. AMRAD's WD4IWG repeater on 147.21 MHz is located at Tysons Corner, VA with remote receivers in Warrenton, VA and Washington, DC. Jeff Brennan, WB4WLW, is the repeater director. The AMRAD Newsletter (Copyright 1995 All Rights Reserved) is mailed six times a year to members and other clubs on an exchange basis. Technical articles, product announcements, news items, and other material related to amateur radio and computing are welcome. A year's free membership is given for original material accepted and published. Classified ads are free to members. Commercial ad rates are available (and very reasonable considering the level of impulse buying that goes on among our membership). The newsletter editor and publisher is Randy Mays, WA6VFC, who had to type all this stuff again when he switched to Microsoft Publisher. Many AMRAD members meet each Saturday afternoon at Tippy's Taco on Highway 29 near Cedar Lane just west of Merrifield, VA. Talk in, when someone remembers to turn on a radio, is on the 147.21 repeater. The AMRAD home page on the Internet is at http://www.amrad.org. There are some GREAT digital pictures on the Web site.

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**and Development Corporation**
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